

## Geologic Setting of the Stillwater River Rockfall

The Stillwater River rockfall site is located along the Stillwater River Road, County Route 420, 2.9 miles northeast of the community of Beehive and 12.5 miles west of the town of Absaroka, Montana. At this location, the Stillwater River has eroded a canyon up to 350 feet deep into the surrounding bedrock of the Sliderock Mountain formation, an informal member of the Upper Cretaceous (100-million to 65-million years old) Livingston Group (Figure 1).

These rocks are composed primarily of andesite (a silica-rich volcanic rock) erupted by a long-since eroded volcano near Sliderock Mountain, and redeposited as mud and debris flows to form the rock layers that are today exposed along the Stillwater River. Individual layers are as thin as a few inches to as much as tens of feet thick and composed of pebbles, cobbles and small boulders in a matrix of sand and silt (conglomerate). Some thin layers of coarse grained, poorly sorted, sandstone separate the thicker layers of conglomerate (Figure 2). As illustrated at locations approximately one mile southwest of the rock fall site, the layers are nearly horizontal, resistant to erosion, and form near-vertical cliffs along the Stillwater River canyon and side drainages (Figures 3 and 4).

Three sets of fractures are visible on Google Earth imagery (Figure 5); one set trends N50°W, a second set trends N20°E, and the third set trends N60°E. In some cases, these fracture sets control the geometry of the cliff faces and produce the associated pinnacles. The N50°W-trending fracture set is subparallel to the Beartooth frontal fault, a reverse fault about three miles south of the rock fall site that bounds the northern edge of the Beartooth Mountains.

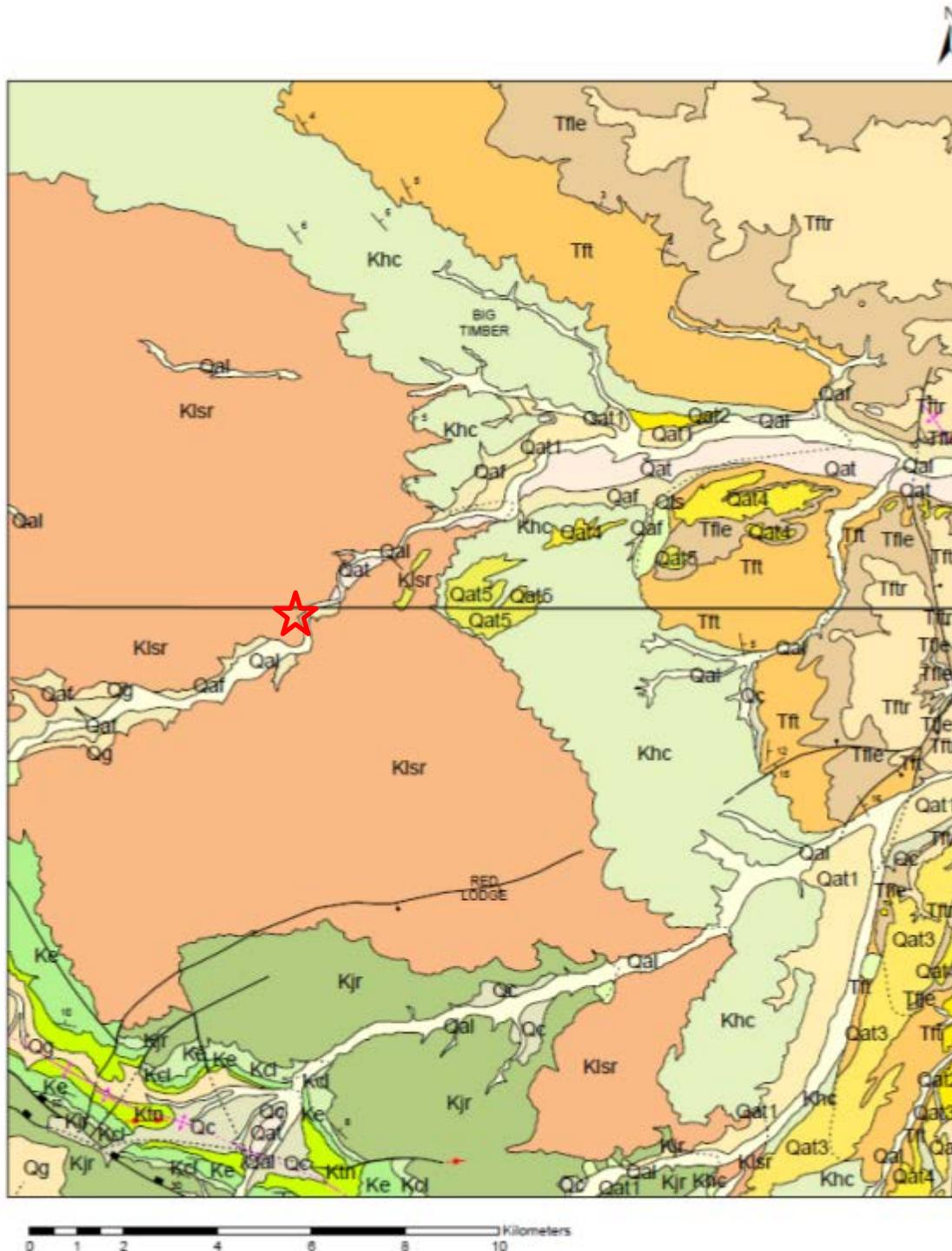


Figure 1. Geologic map showing various rock types surrounding the Stillwater River road rockfall (marked by red star). The orange unit labeled Klsr is the Sliderrock Mountain formation. Units labeled Qat—alluvial terrace, Qal—alluvium, Qaf—alluvial fan, and Qg—glacial deposits are recent (Quaternary) deposits along the Stillwater River valley. The complete Red Lodge and Big Timber geologic maps are available from: <http://www.mbm.mtech.edu/gmr/gmr-statemap.asp#quadmaps>.



Figure 2. Nearly horizontal beds of the Sliderock Mountain formation. The light-colored bed at the bottom of the outcrop is coarse sand. It is overlain by thicker beds of conglomerate that contain visible pebbles. Kevin Chandler photo.



Figure 3. Cliffs formed in the Sliderock Mountain formation near Beehive, approximately one mile southwest of the rock fall site. Note nearly horizontal bedding and near-vertical cliff faces formed along the regional fracture pattern. Kevin Chandler photo.



Figure 4. Rock pinnacles near Beehive illustrate weathering and erosion along fracture planes. Kevin Chandler photo.

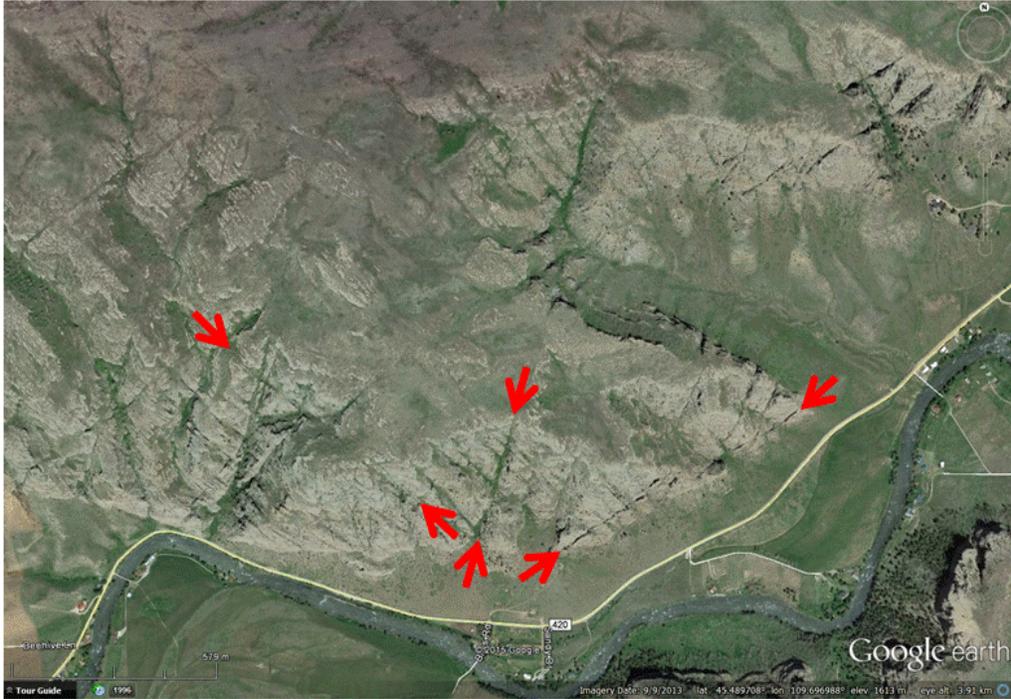


Figure 5. Three fracture-sets, clearly visible in bedrock approximately one mile southwest of the Stillwater River rock fall (better exposed here than at the rock fall site), trend  $N50^{\circ}W$ ,  $N20^{\circ}E$ , and  $N60^{\circ}E$ .

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